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EXAMINER	
REDDING, THOMAS M	

ART UNIT	PAPER NUMBER
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/802,088	YANG ET AL.	
	Examiner	Art Unit	
	THOMAS M. REDDING	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 May 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/21/2008 has been entered. Claims 1-44 are currently pending.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 6, 9, 12, 21, 26, 29, 32, 41, 42 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atashroo (US 5,703,970) in combination with Kondo et al. (US 6,404,917).

Regarding claims 1, 21, 41, 42 and 44, Atashroo discloses [a] system for efficiently performing a pattern matching procedure, comprising:

[a] system for efficiently performing a pattern

matching procedure using an electronic apparatus, comprising:

an enrollment manager that performs an image conversion procedure for converting an initial reference image into a reference template ("The apparatus may further comprise means for storing the first image at a first time and means for acquiring the second image at a second time later than the first time", Atashroo, column 2, line 64),

said image conversion procedure including a binarization procedure and a symmetrical reduction procedure ("The DFT of each row is a complex but symmetric row. Therefore, only the first (N/2+1) points of each row's DFT are stored in the corresponding row as the outputs, thus building a complex array of size M by (N/2+1)", Atashroo, column 4, line 55 and figure 3(b)); and

a verification manager that converts an initial test image into a transformed test image ("Similarly, the second array undergoes a domain transform in a second domain transformer 50", Atashroo, column 4, line 21),

said verification manager then combining said reference template and said transformed test image into a correlation image ("The output of the symmetric domain transformer 70 is the real circular cross-correlation function array, i.e., real correlation matrix, of size M by N", Atashroo, column 5, line 44),

said verification manager analyzing matching characteristics of said correlation image to determine whether said initial test image matches said initial reference image ("the result may be provided to a recognition unit 90 which provides an indication or takes some required action on the basis of the existence of a threshold degree of correlation", Atashroo, column 5, line 49).

Atashroo does not teach a binarization procedure converting a non-binary number format into a binary number format.

Kondo, working in the same problem solving area of data compression does teach a binarization procedure converting a non-binary number format into a binary number format (Kondo, column 5, lines 46-67, Kondo teaches binarizing a pixel parameter and encoding the binary values in individual bits).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the binarization and bit encoding method taught by Kondo in the image correlator system of Atashroo to compress the data requiring less memory space for storage ("The compression of the luminance data "Y" will be described next", Kondo, column 5, line 38).

Further regarding claim 41, Atashroo teaches a computer-readable medium comprising program instructions for performing the steps of his method ("The processor 20 can be implemented as any off-the-shelf FFT processor, a digital signal processor, or general purpose processor suitably programmed with a program stored in a memory 25 to perform one dimensional FFT and/or arithmetic operations in hardware or software. The memory 25 may be a hard disk, ROM, RAM, or removable magnetic media such as a diskette.", Atashroo, column 3, line 43).

Further regarding claim 42, the means plus element required by this claim, "For example,electronic device 110 may readily be implemented as a computer" (page 8, line 5) is met by the use of a computer to implement the method of Atashroo (see claim 41 above).

Further regarding claim 44, the only new element over claim 1 is the distinction of the system comprising an "electronic device" that performs the procedure. A computer is an electronic device, and Atashroo teaches the use of a computer to implement his method as discussed above.

Regarding claims 6 and 26, the combination of Atashroo and Kondo teaches The system of claim 1 wherein said initial reference image is converted by a Fast Fourier Transform procedure into an FFT reference image that exhibits symmetrical characteristics across individual complex pixel values, said enrollment manager performing said symmetrical reduction procedure on said FFT reference image to produce a reduced reference image to conserve processing requirements and memory requirements, said FFT reference image being divided during said symmetrical reduction procedure into a reduced portion that is stored as said reference template ("the output of the first domain transformer 40 is half of a complex but symmetric array of size M by N", Atashroo, column 3, last line), and a discarded portion that is not utilized during said pattern matching procedure (Atashroo, column 5, lines 1-18).

Regarding claims 9 and 29, the combination of Atashroo and Kondo teaches [t]he system of claim 1 wherein said enrollment manager converts said initial reference image into an FFT reference image by performing a Fast Fourier Transform procedure upon said initial reference image ("The <u>first</u> and second domain transformers preferably perform real two dimensional fast fourier transforms", Atashroo, column 2, line 55).

Regarding claims 12 and 32, the combination of Atashroo and Kondo teaches [t]he system of claim 1 wherein said verification manager converts said initial test image into an FFT test image by performing a Fast Fourier Transform procedure upon said initial test image("The first and <u>second</u> domain transformers preferably perform real two dimensional fast fourier transforms", Atashroo, column 2, line 55) .

4. Claims 2, 3, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larsson et al. (US 2004/0215615 A1) in combination with Atashroo (US 5,703,970) and further in combination with Kondo et al. (US 6,404,917).

Regarding claims 2 and 22 Larsson teaches a system to wherein an image capture device provides said initial reference image for creating said reference template (Larsson, figure 2, references 20 and 23), said pattern matching procedure utilizing said reference template to verify a user identity of a system user corresponding to said initial test image (Larsson figure 4, references 47-50).

Larsson is silent on the details of performing the actual correlation step.

Atashroo and Kondo does teach a correlation apparatus and method with all the elements of claim 1 as given above.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the improved image correlation technique of Atashroo and Kondo to perform the correlation functions required by Larsson with speed and efficiency ("the computational load for the method according to the invention is of Order ((M*N) log (M*N)) compared with the Order ($(M*N)^2$) for direct method of computing the circular cross correlation function", Atashroo, column 1, line 41).

Regarding claims 3 and 23, the combination of Larsson, Atashroo and Kondo does teach [an] initial reference image and said initial test image each includes image data that represents a user fingerprint or a user face of a corresponding system user (Larsson figure 2, reference 20).

5. Claims 7 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atashroo (US 5,703,970) and Kondo et al. (US 6,404,917) in combination with Yasrebi et al. (ACM SIGARCH, 1984).

Regarding claims 7 and 27, the combination of Atashroo and Kondo teaches all the elements of claim 1 as give above, and also teaches said verification manager creates said correlation image by performing a multiplication procedure that multiplies corresponding pixel values from said reference template and said transformed test

image to produce correlation pixel values for said correlation image ("The multiplier 60 computes the point product of each corresponding pair of the two input complex arrays after conjugating the complex numbers in one of the input complex arrays, and, then stores the result in a corresponding position. The output of the multiplier 60 is also a complex array of size M by (N/2+1) that is half of a whole symmetric complex array", Atashroo, column 5, line 2).

The combination of Atashroo and Kondo does not teach that said correlation pixel values being obtained from a multiplication lookup table to conserve system resources such as processing requirements and memory requirements.

Yasrebi et al., working in the same field of endeavor of FFT analysis, teaches correlation pixel values being obtained from a multiplication lookup table to conserve system resources such as processing requirements and memory requirements. ("the results on the different moduli can be stored in look-up tables", Yasrebi, page 22, column 2, paragraph 4).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use a lookup table as taught by Yasrebi in the image correlation system of the combination of Atashroo and Kondo in order to have "the ability to do arithmetic operations such as +, -, and * (in one memory cycle)" (Yasrebi, page 22, column 2, paragraph 4). It also is extremely well known in the field of computer programming, particularly in real-time programming (of embedded systems and the like), to use tables

in memory space to gain execution speed by moving computation out of code loops by pre-calculating tables of values and using relatively quick memory accesses in these time critical areas.

6. Claims 4, 10, 11, 13 - 16, 24, 30, 31 and 33 – 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atashroo (US 5,703,970) and Kondo et al. (US 6,404,917) in combination with Hansche (Applied Optics, 1989). .

Regarding claims 4 and 24, the combination of Atashroo and Kondo teach all the elements of claim 1 as given above. The combination of Atashroo and Kondo does not teach a first binarization step to create initial binarization values for said binarization procedure by substituting a decimal value of "1" for all complex coefficients from said initial reference image that are greater than or equal to zero, said enrollment manager also substituting a decimal value of "- 1" for all of said complex coefficients that are less than zero, said initial binarization values then being utilized for any further calculations during said pattern matching procedure.

Hansche, working in the same field of endeavor of pattern matching through correlation in the Fourier domain, does teach a first binarization step to create initial binarization values for said binarization procedure by substituting a decimal value of "1" for all complex coefficients from said initial reference image that are greater than or equal to zero, said enrollment manager also substituting a decimal value of "- 1" for all of said complex coefficients that are less than zero, said initial binarization values then

being utilized for any further calculations during said pattern matching procedure ("H_{QPOF} = sgn{Re[*G(w)*} + *i* * sgn{Im[*G(w)*]}", Hansche, page 4840, column 1, equation 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply the Quad-Phase-Only filter of Hansche to the pattern matching system of Atashroo and Kondo to take advantage of its "superior discriminatory capability for certain targets (Hansche, page 4833, column 1, 2nd paragraph). It also would provide a filter with the most compact representation practical that would still be able to distinguish between a target and its mirror image.

Regarding claims 10 and 30, the combination of Atashroo, Kondo and Hansche teaches a two-step binarization procedure upon said FFT reference image to produce a binarized reference image that is stored with a single binary bit representing each complex pixel value coefficient (Hansche, page 2890, column 1, paragraph 4, and the rejection of claim 5 above).

Regarding claims 11 and 31 the combination of Atashroo, Kondo and Hansche teaches a symmetrical reduction procedure upon said binarized reference image to produce a reduced reference image which said enrollment manager stores as said reference template (Atashroo, column 4, line 55 and figure 3(b), and Hansche, page 2890, column 1, paragraph 4 as above)

Regarding claims 13 and 33, the combination of Atashroo, Kondo and Hansche teaches all the elements of claim 12 wherein said verification manager performs a two-step binarization procedure upon said FFT test image to produce a binarized test image that is stored with a single binary bit representing each complex pixel value coefficient (Hansche, page 2890, column 1, paragraph 4, and the rejection of claim 5 above).

Regarding claims 14 and 34, the combination of Atashroo, Kondo and Hansche teach the elements of claim 13 and a symmetrical reduction procedure upon said FFT test image to produce and store a reduced test image (Atashroo, column 4, line 55 and figure 3(b)).

Regarding claims 15 and 35, the combination of Atashroo, Kondo and Hansche teach the elements of claim 14 and a complex conjugation procedure upon said reference template to produce a conjugated reference image, said complex conjugation procedure converting each pixel value from said reference template into a corresponding complex conjugate value by inverting an arithmetic operation that

connects real and imaginary portions of complex values for said each pixel value from said reference template ("The multiplier 60 computes the point product of each corresponding pair of the two input complex arrays after conjugating the complex numbers in one of the input complex arrays", Atashroo, column 5, line 2).

Regarding claims 16 and 36, the combination of Atashroo, Kondo and Hansche teach the elements of claim 15 wherein said verification manager performs a multiplication procedure with said conjugated reference image and said reduced test image to produce a reduced correlation image ("The multiplier 60 computes the point product of each corresponding pair of the two input complex arrays after conjugating the complex numbers in one of the input complex arrays, and, then stores the result in a corresponding position. The output of the multiplier 60 is also a complex array of size M by (N/2+1) that is half of a whole symmetric complex array", Atashroo, column 5, line 2).

7. Claims 5 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atashroo (US 5,703,970), Kondo et al. (US 6,404,917) and Hansche (Applied Optics, 1989) in combination with Bargeton et al. (US 4,402,075).

Regarding claims 5 and 25, the combination of Atashroo, Kondo and Hansche does not explicitly teach a second binarization step to create stored binarization values for said binarization procedure by substituting a binary value of "1" for all of said complex coefficients from said initial binarization values that are equal to "-1", and by

also substituting a binary value of "0" for all of said complex coefficients from said initial binarization values that are equal to "1", said complex coefficients thus each being expressed with a single binary bit, said stored binarization values subsequently being converted into said initial binarization values for performing any required mathematical calculations.

However, it is certainly well known in the computer arts to store or encode data that has two states (e.g. –1 and +1) as binary digits (0 and 1) in order to consume minimal storage space. The assignment of code to symbol is arbitrary as long as it is consistent (Official Notice). (Bargeton et al. US 4,402,075, "This coupler 12 comprises at least one binary-to-bipolar converter and a forward repeater which are peculiar to the monitor terminal, together with a bipolar-to -binary converter and repeater which are associated with the backward channel", column 10, line 41)

Using this concept, the bipolar information described above in claim 4 would naturally map –1 to 0 and 1 to 1, or alternatively 1 to 0 and –1 to 1.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to add to the Atashroo, Kondo and Hansche combination given above, the bipolar to unipolar conversion of Bargeton to permit compact storage.

8. Claims 17, 18, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atashroo (US 5,703,970), Kondo et al. (US 6,404,917) and Hansche (Applied Optics, 1989), in combination with Yasrebi et al. (ACM SIGARCH, 1984).

Regarding claims 17 and 37, the combination of Atashroo, Kondo and Hansche teach the elements of claim 16. The combination of Atashroo, Kondo and Hansche is silent on the use of said verification manager performs said multiplication procedure by referencing a multiplication lookup table to index pixel values from said conjugated reference image and said reduced test image to produce corresponding correlation pixel values for said reduced correlation image.

Yasrebi et al., working in the same field of endeavor of FFT analysis teach a multiplication procedure by referencing a multiplication lookup table ("the results on the different moduli can be stored in look-up tables", Yasrebi, page 22, column 2, paragraph 4).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use a lookup table as taught by Yasrebi in the image correlation system of the combination of Atashroo, Kondo and Hansche in order to have "the ability to do arithmetic operations such as +, -, and * (in one memory cycle)" (Yasrebi, page 22, column 2, paragraph 4). It also is extremely well known in the field of computer programming, particularly in real-time programming (of embedded systems and the like), to use tables in memory space to gain execution speed by moving computation out of code loops by pre-calculating tables of values and using relatively quick memory accesses in these time critical areas.

Regarding claims 18 and 38, the combination of Atashroo, Kondo, Hansche and Yasrebi teach the elements of claim 17 a symmetrical regeneration procedure upon said reduced correlation image to produce a full FFT correlation image ("Then, as shown in FIG. 4(b), the second half of each row of the resulting array is set using the symmetry property of Fourier Transform to create a supplemented array", Atashroo, column 5, line 27)

9. Claims 8 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atashroo (US 5,703,970) , Kondo et al. (US 6,404,917) and Yasrebi et al. (ACM SIGARCH, 1984) and further in view of Hansche (Applied Optics, 1989).

Regarding claims 8 and 28, the combination of Atashroo, Kondo, and Yasrebi teach all the elements of claim 7 as given above. The combination of Atashroo, Kondo and Hansche teach the elements of claim 8 and 28 that are common with claim 4.

Atashroo teaches the method of multiplying a transform of a test image by a transform of a template image as part of the process of determining a correlation image.

As described in the rejection of claim 4 above, It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply the Quad-Phase-Only Filter of Hansche to the pattern matching system of Atashroo. It is noted that Hansche teaches constraining each of the transform arrays to 4 possible phase values

of "1 + j", "1 - j", "- 1 + j", and "- 1 -j", as suggested by equation 1 (i.e., page 4840, column 1 of Hansche).

Yasrebi, as applied to claim 7 above, teaches the use of a lookup table to improve processing efficiency for mathematical operations in computation.

While the prior art teaches the individual claimed elements, the combination does not describe an actual combination commensurate with the requirements of claim 8, which recites the logical row and column configuration of a lookup table.

However, considering the high skill level and education of one of ordinary skill in the art, (i.e., the Image Processing art), and given that the individual claim elements are taught collectively by the references as described above, the construction and implementation of the lookup table recited in claim 8 would have been obvious to one of ordinary skill in the art. That is, the mere row and column logical arrangement of a lookup table to perform the multiplication of two images represented using binarized complex numbers is well within the skill set of one of ordinary skill in the art, and the arrangement of the claimed lookup table would have been suggested using the common sense, reasoning, and logic commensurate with that skill set. This conclusion, taken in combination with the fact that the prior art teaches each claimed element, whereby the individual elements (i.e., the multiplicative correlation of Atashroo, the binarization of complex number of Hansche, and the look-up table of Yasrebi) could have been combined using known programming and image processing techniques and taken in combination, each element performs as it did separately, whereby the results of the entire combination are completely predictable, leads to the conclusion that the

Comment [tmr1]: Is this pushing things a bit. Should we just claim ordinary skill?

combination as a whole would have been obvious (*KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007).

Comment [tmr2]: My attempt at a KSR style obviousness rejection. Seems too specific to do a standard 103 on but certainly feels like it fits under the obviousness strategy where we have established that we have all the parts and it would be predictable to assemble them and get known benefits.

10. Claims 19, 20, 39, 40 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atashroo (US 5,703,970), Kondo et al. (US 6,404,917), Hansche (Applied Optics, 1989) and Yasrebi et al. (ACM SIGARCH, 1984), in combination with Bhagavatula et al. (US 2005/0018925) and McGillem et al. (Saunders College Publishing, 1991).

Regarding claims 19 and 39, the combination of Atashroo, Kondo, Hansche and Yasrebi teach the elements of claim 18 and an inverse FFT procedure upon said full FFT correlation image to generate a complex correlation image, said verification manager discarding imaginary values from each pixel value of said complex correlation image to produce a real correlation image ("Only the real component of the result is stored in the corresponding row. The imaginary component of the result will necessarily be zero", Atashroo, column 5, line 40).

The Atashroo, Kondo, Hansche and Yasrebi combination does not teach said verification manager then performing an FFT shift procedure to generate a correlation graph that represents pixels from said real correlation image.

Bhagavatula does teach a shift procedure to generate a correlation graph that represents pixels from said real correlation image ("one can first locate the position of the face in the smaller resolution image and estimate the correct face region in the high

resolution background image, and then shift the crop window and downsample the estimated region containing the face, and then perform verification", Bhagavatula, page 11, paragraph 121)

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the centering technique of Bhagavatula with the image correlation system of Atashroo, Kondo, Hansche and Yasrebi in order to avoid imposing position constraints on the user and to improve overall processing speed by focusing on the target of real interest ("To not constrain the user and for purposes of increasing the speed of the overall verification process, it may be desirable to implement a face localizer which locates the face and centers it for the classification", Bhagavatula, page 11, paragraph 121).

The combination of Atashroo, Kondo, Hansche, Yasrebi and Bhagavatula does not explicitly teach performing an FFT shift procedure. Bhagavatula is silent as to the method used to achieve the shift, whether done in the spatial domain or the frequency domain.

McGillem teaches implementing a shift in the spatial domain by means of a phase shift in the frequency domain ("Delay in the time domain is, thus seen to correspond to introduction of a phase shift in the frequency domain", McGillem, page 142).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the phase shifting technique taught by McGillem to

implement the centering technique taught by Bhagavatula to avoid the computation expense of calculating a new FFT for a window shifted in the spatial domain.

Regarding claims 20 and 40, the combination of Atashroo, Kondo, Hansche, Yasrebi, Bhagavatula and McGillem teach the elements of claim 19.

The combination does not teach said verification manager computes a peak side-lobe ratio from said correlation graph for comparing with a pre-determined correlation threshold to determine whether said initial test image matches said initial reference image, said peak side-lobe ratio being expressed by a formula:

PSR = (Peak Value - Mean Value) / STD

where said PSR is said peak side-lobe ratio, said Peak Value is a correlation image pixel with a greatest magnitude, said Mean Value is an arithmetical mean value of correlation image pixels in a pre-defined side-lobe area surrounding said Peak Value, and said STD is a standard deviation of said correlation image pixels in said pre-defined side-lobe area.

Bhagavatula does further teach a verification manager computes a peak side-lobe ratio from said correlation graph for comparing with a pre-determined correlation threshold to determine whether said initial test image matches said initial reference image, said peak side-lobe ratio being expressed by a formula:

PSR = (Peak Value - Mean Value) / STD

where said PSR is said peak side-lobe ratio, said Peak Value is a correlation image pixel with a greatest magnitude, said Mean Value is an arithmetical mean value of correlation image pixels in a pre-defined side-lobe area surrounding said Peak Value, and said STD is a standard deviation of said correlation image pixels in said pre-defined side-lobe area ("The mean and standard deviation ("σ") of the sidelobe region are computed and used to estimate the PSR using Eq. (2). PSR estimation is depicted pictorially in FIG. 3.

$$PSR = \frac{peak - mean}{\sigma} \qquad (2)$$

", Bhagavatula, page 2, paragraph 16 and equation 2 on page 3).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the centering technique of Bhagavatula with the image correlation system of Atashroo, Kondo, Hansche, Yasrebi, Bhagavatula and McGillem since it is a commonly used metric to judge the quality of a correlation ("the peak-to-sidelobe ratio (PSR), is usually employed to measure the peak sharpness", Bhagavatula, page 2, paragraph 16)

Regarding claim 43, the combination of Atashroo, Kondo, Hansche, Yasrebi, Bhagavatula and McGillem teach [a] system for efficiently performing a pattern matching procedure, comprising:

$$H_{QPOF} = \mathrm{sgn}\{\mathrm{Re}[G(\omega)]\} + i \cdot \mathrm{sgn}\{\mathrm{Im}[G(\omega)]\}. \qquad (1)$$

a electronic device that performs an image conversion procedure for converting an initial reference image into a reference template ("The apparatus may further comprise means for storing the first image at a first time and means for acquiring the second image at a second time later than the first time", Atashroo, column 2, line 59, the first image clearing being a pattern or template to be used for comparison purposes), said image conversion procedure including a binarization procedure ("H_{QPOF} = sgn{Re[*G(w)*} + *i* * sgn{Im[*G(w)*]}", Hansche, page 4840, column 1, equation 1); said electronic device analyzing matching characteristics of a test image and said reference template to determine whether said test image matches said reference template ("The mean and standard deviation ("σ") of the sidelobe region are computed and used to estimate the PSR using Eq. (2). PSR estimation is depicted pictorially in FIG. 3.

$$PSR = \frac{peak - mean}{\sigma} \qquad (2)$$

", Bhagavatula, page 2, paragraph 16 and equation 2 on page 3)..

Response to Arguments

Summary of Applicant's Remarks: Regarding amended claims 1, 21, 41, 42, and 44 the art used in the previous rejection does not teach converting a non-binary number format into a binary number format.

Examiner's Response: Arguments are moot in view of new grounds of rejection. See updated rejection above.

Summary of Applicant's Remarks: Claims 6, 9, 12, 26, 29 and 32 have been amended to recite "a <u>single</u> Fast Fourier Transform procedure" to differentiate from Atashroo which teaches using a sequence of one-dimensional FFTs.

Examiner's Response: The two-dimensional DFT is a linear operation that can be factored into one-dimensional DFTs on each axis (Yasrebi, page 21, column 2, 2nd paragraph, and Castleman, pages 194, 195). The methods used by Atashroo and applicant are mathematically equivalent. Further, Atashroo is reciting a single 2-dimensional Fast Fourier Transform procedure. It is implemented as a sequence of 1-dimensional transforms. Applicant's disclosure does not provide any detail as to the implementation of his single Fast Fourier Transform procedure.

Summary of Applicant's Remarks: Applicant asserts that Yasrebi's lookup table is not comparable to their table as the referenced "moduli" are not pixel values. Applicant further states that there are secondary considerations including a long-felt need for their solution in the relevant technical field, and other entities and individuals in analogous arts have apparently failed to successfully overcome the foregoing problems in the manner disclosed by Applicants.

Examiner's Response: The Yasrebi reference was used to teach the concept of a look-up-table. The specifics of Yasrebi's implementation are not relevant. Moreno (A Wrapper for Look-Up Tables (LUT) Operations in C++) is cited as a further evidentiary reference. Further, the mere assertion of secondary considerations carries no weight ("the lack of objective evidence of nonobviousness does not weigh in favor of obviousness").

Merely stating secondary considerations is not proof. Evidence needs to be shown for the argument to have merit.

I. TO BE OF PROBATIVE VALUE, ANY OBJECTIVE EVIDENCE SHOULD BE SUPPORTED BY ACTUAL PROOF

Objective evidence which must be factually supported by an appropriate affidavit or declaration to be of probative value includes evidence of unexpected results, commercial success, solution of a long-felt need, inoperability of the prior art, invention before the date of the reference, and allegations that the author(s) of the prior art derived the disclosed subject matter from the applicant. See, for example, In re De Blauwe, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984) ("It is well settled that unexpected results must be established by factual evidence." "[A]ppellants have not presented any experimental data showing that prior heat-shrinkable articles split. Due to the absence of tests comparing appellant's heat shrinkable articles with those of the closest prior art, we conclude that appellant's assertions of unexpected results constitute mere argument."). See also In re Lindner, 457 F.2d 506, 508, 173 USPQ 356, 358 (CCPA 1972); Ex parte George, 21 USPQ2d 1058 (Bd. Pat. App. & Inter. 1991).

II. ATTORNEY ARGUMENTS CANNOT TAKE THE PLACE OFEVIDENCE

The arguments of counsel cannot take the place of evidence in the record. In re Schulze, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965). Examples of attorney statements which are not evidence and which must be supported by an appropriate affidavit or declaration include statements regarding unexpected results, commercial success, solution of a long-felt need, inoperability of the prior art, invention before the date of the reference, and allegations that the author(s) of the prior art derived the disclosed subject matter from the applicant.
See MPEP § 2145 generally for case law pertinent to the consideration of applicant's rebuttal arguments. (MPEP § 716.01(b) I & II)

Further, with respect to others apparently not applying this technique before for this application, lack of anticipation is not evidence of non-obviousness.

Summary of Applicant's Remarks: Regarding claims 4 and 24, the elements of Hansche cited do not teach a substitution technique that is part of a "first binarization step".

Examiner's Response: The equation cited in Hansche, ("H_{QPOF} = sgn{Re[$G(w)$} + i * sgn{Im[$G(w)$]}", Hansche, page 4840, column 1, equation 1) is a conversion to bipolar binary coefficients. The sgn (signum) function returns the sign of the argument as either 1 or -1. Although the form of the equation still expresses the result as a complex number (one of : 1 + i, 1-i, -1+i, -1-i), Hansche is binarizing the coefficients (converting to the unit circle), precisely as described in the claim. This step in Hansche is substituting bipolar binary coefficients in place of the original coefficients.

Summary of Applicant's Remarks: Regarding claims 5 and 25, Bargeton does not disclose the specific binarization details recited by Applicants in the claims.

Examiner's Response: It is known to convert data between binary bipolar form to a unipolar binary and vice versa. It is a one-to-one mapping and no data is lost in the conversion (Bargeton et al. US 4,402,075, "This coupler 12 comprises at least one binary-to-bipolar converter and a forward repeater which are peculiar to the monitor terminal, together with a bipolar-to -binary converter and repeater which are associated

with the backward channel", column 10, line 41). Bargeton discloses the binary to bipolar conversion that is recited in the claims.

Summary of Applicant's Remarks: Regarding claims 8 and 28, Examiner utilized Official Notice without expressly stating so. The construction and implementation of the details of this particular lookup table would not have been obvious at the time the invention was made. The results would not have been well-known or predictable.

Examiner's Response: The rejection of claim 8 and 28 is an obviousness rejection constructed along the guidelines of the 2007 KSR case (see *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385, U.S. 2007). Official Notice was not invoked nor was it required as Official Notice is used as a placeholder for very well known elements that are considered obvious. The rejection explained that all the required elements were well known at the time of the invention and cited relevant art for each element. In particular the construction of a lookup table within the constraints of the problem was well within the abilities of one of ordinary skill in the art. With the previously determined set of inputs (1 + i, 1 - i, -1+ i, -1- i) as taught by Hansche, there are only a finite number of ways to arrange these inputs to construct a table, pretty much all the same except for ordering which can be considered to be arbitrary. The possible outputs are defined by the relationship established by the original equation and the result achieved through the lookup table must match the result of the equation. As the function provided by the lookup table is a mathematical expression, the result of using such a table is certainly

predictable (i.e. to be of any practical value, it must be equivalent to the computation using the original equations).

Summary of Applicant's Remarks: Regarding claims 19 and 39, Bhagavatula does not teach an FFT shift procedure to generate a correlation graph.

Examiner's Response: Bhagavatula does teach a shift procedure to generate a correlation graph that represents pixels from said real correlation image ("one can first locate the position of the face in the smaller resolution image and estimate the correct face region in the high resolution background image, and then shift the crop window and downsample the estimated region containing the face, and then perform verification", Bhagavatula, page 11, paragraph 121). As Bhagavatula was not real clear on which domain his shift was implemented, the teachings of McGillem were added to explain the equivalent operation in the Fourier domain.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kretschmer et al. (US 4,626,854) teaches an FFT shift to line up FFT correlation plots of pulses.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS M. REDDING whose telephone number is (571)270-1579. The examiner can normally be reached on Mon - Fri 7:30 am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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